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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/002,576	10/26/2001	Changmin Chun	ECB-0115	4233

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EXAMINER

WILKINS III, HARRY D

ART UNIT PAPER NUMBER

1742

DATE MAILED: 02/06/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/002,576

Applicant(s)

CHUN ET AL.

Examiner

Harry D Wilkins, III

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 16 December 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,2,6 and 7 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,2,6 and 7 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 26 October 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. §§ 119 and 120

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 13) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.
- a) ☐ The translation of the foreign language provisional application has been received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

DETAILED ACTION

1. The rejection under 35 USC 103 over Ramanarayanan et al in view of Applicant's admission and Garg et al has been withdrawn in view of newly cited art Hemsath et al.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 1, 2 and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ramanarayanan et al (US 5,869,195) in view of Applicant's admission of prior art, Garg et al (US 6,287,393) and Hemsath et al (US 5,997,286).

Ramanarayanan et al teach a method where a pearlitic surface layer is formed on a steel article. Ramanarayanan et al teach (see col 2, line 66 to col 3, line 12) that a surface layer of at least 1 micron is transformed by conventional carburizing methods. The method includes (equivalent to (c) of present invention) slow cooling from the carburizing treatment in order to form the pearlite microstructure. Ramanarayanan et al teach (see col 3, lines 9-12) that when the surface pearlite was formed, only the surface layer was required to have more than 0.7 wt% C. Thus, the bulk alloy (i.e.-pre-carburized) of Ramanarayanan et al contains less than 0.7 wt% C.

Ramanarayanan et al do not teach the claimed method of carburizing of (a) heating to the austenite region and (b) exposing to a supersaturated carbon environment at 727-900°C.

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Garg et al teach (see col 5, lines 24-46 and col. 9, lines 38-64) a method of carburizing steel that includes (a) heating at 750-950°C and (b) exposing the steel to a carburizing atmosphere containing CO and H₂. The atmosphere can contain as much as 50 vol% CO (where n=1 and m=0, both within the range of Garg et al), with no N₂ added, thus leaving the other 50 vol% to be essentially all H₂. There would be some residual methane and/or CO₂ in the atmosphere, but not enough to affect the carburizing. Thus, the atmosphere composition taught by Garg et al consists essentially of CO and H₂. Though Garg et al do not contain any express teachings regarding the saturation or carbon activity of the atmosphere, one of ordinary skill in the art would have expected that with the 50/50 CO/H₂ atmosphere, the carbon activity would have been increased, thereby creating a supersaturated environment, because more carbon in the atmosphere (higher carbon activity) increases the rate of carbon transfer to the iron and also increases the maximum carbon content of the iron (for support, see "Gas Carburizing").

Therefore, it would have been obvious to one of ordinary skill in the art to have performed the conventional heating and carburizing steps as taught by Garg et al as the carburizing treatment of Ramanarayanan et al because the CO/H₂ environment of Garg et al is effective at quickly facilitating carbon transfer to the steel (see Garg et al at col 7, lines 5-24).

Garg et al teach (see col. 5, lines 32-35) that the process of carburizing is carried out at 750-950°C in a batch or continuous furnace in the presence of a carburizing

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atmosphere. However, Garg et al does not expressly teach when the steel article is exposed to the carburizing atmosphere.

Hemsath et al teach (see abstract and col. 6, lines 48-62) that a continuous furnace for carburizing articles includes a separate preheating zone for deoiling of the article and a carburizing zone where the carburizing atmosphere is introduced to the preheated article.

Therefore, it would have been obvious to one of ordinary skill in the art to have performed a preheating step as taught by Hemsath et al prior to exposing the article to the carburizing atmosphere of Garg et al because the preheating allows for the article to be deoiled (i.e.-cleaned). The preheating (to the temperature of carburizing) would inherently convert portions of the ferrite to austenite because the temperature at which ferrite starts to convert to austenite is 723°C and the heating is to a temperature of 750-950°C.

Ramanarayanan et al further teach that an FeS surface layer is formed on top of the pearlite layer in order to add corrosion resistance to acids. However, Applicant admits as prior art (see paragraph 3) that pearlite was known to be resistant to corrosion by organic acids. Therefore, the FeS layer of Ramanarayanan et al is not needed as the pearlite layer provides sufficient corrosion resistance for certain environments.

Regarding claim 2, Ramanarayanan et al teach (see col 2, lines 49-52) that preferred steels include 0.6-0.9 wt% Mn and 0.1-0.5 wt% Si.

Regarding claim 7, Ramanarayanan et al teach (see col 1, lines 41-42) that the thickness of the pearlitic region is preferably at least 20 microns.

4. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ramanarayanan et al (US 5,869,195) in view of Applicant's admission of prior art, Garg et al (US 6,287,393) and Hemsath et al (US 5,997,286) as applied to claims 1, 2 and 7 above, and further in view of Kerridge (US 4,461,655).

Ramanarayanan et al, Applicant's admission, Garg et al and Hemsath et al do not teach that the carburizing time was about 1 minute to about 50 hours as claimed.

Kerridge teaches that treatment time affects carburized depth (see col 3, lines 22-27).

Therefore, it would have been within the expected skill of a routineer in the art to have optimized the time of treatment in order to adjust the depth of the carburized layer that forms pearlite upon slow cooling because Kerridge teaches that treatment time affects carburized depth (see col 3, lines 22-27).

Response to Arguments

5. Applicant's arguments with respect to claims 1, 2, 6 and 7 have been considered but are moot in view of the new ground(s) of rejection. However, the Examiner would like to respond to one of Applicant's arguments, particularly that the statement in Ramanarayanan et al regarding the surface carbon content supports an unexpected and unobvious feature of the present invention. The Examiner disagrees. The present claims state that the starting steel composition contains less than 0.77 wt% C, and that post-carburizing the whole of the article contains less than 0.77 wt% C, not that the

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surface contains less than 0.77 wt% C. The small amount of C added in the thin surface layer (20 microns) would not increase the total amount of carbon above 0.77 wt%. Nevertheless, at the very least, there is overlap between the presently claimed range and the range disclosed by Ramanarayanan et al (i.e.- 0.7 wt% C to 0.77 wt% C).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Harry D Wilkins, III whose telephone number is 571-272-1251. The examiner can normally be reached on M-Th 10:00am-8:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Roy V King can be reached on 571-272-1244. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9306 for regular communications and (703) 872-9306 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 571-272-1700.

Harry D Wilkins, III
Examiner
Art Unit 1742

hdw

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